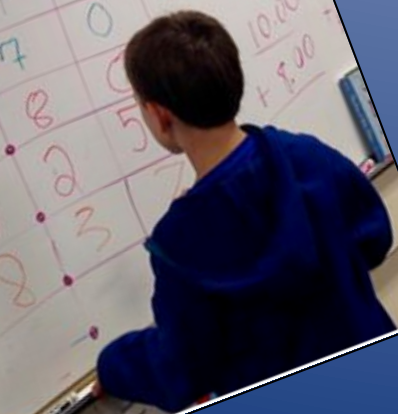


K- 4 Classrooms



What We Know from Research

- ◆ Problem solving requires more than procedural skills
- ◆ The ability to represent the problem is critical
- ◆ Useful representations, like diagrams, allow students to:
 - * Reflect on the representations
 - * Modify the representations
 - * Link the representations to suitable strategies, computations and procedures

MATH PROBLEM SOLVING

1. Understand

- Read the problem
- Summarize the story problem
- Visualize
- Write an answer sentence frame



2. Represent

- What kind of problem is this?
- Use manipulatives or draw a picture to represent the problem
- Write an equation



3. Solve

- Do the math
- Show your work



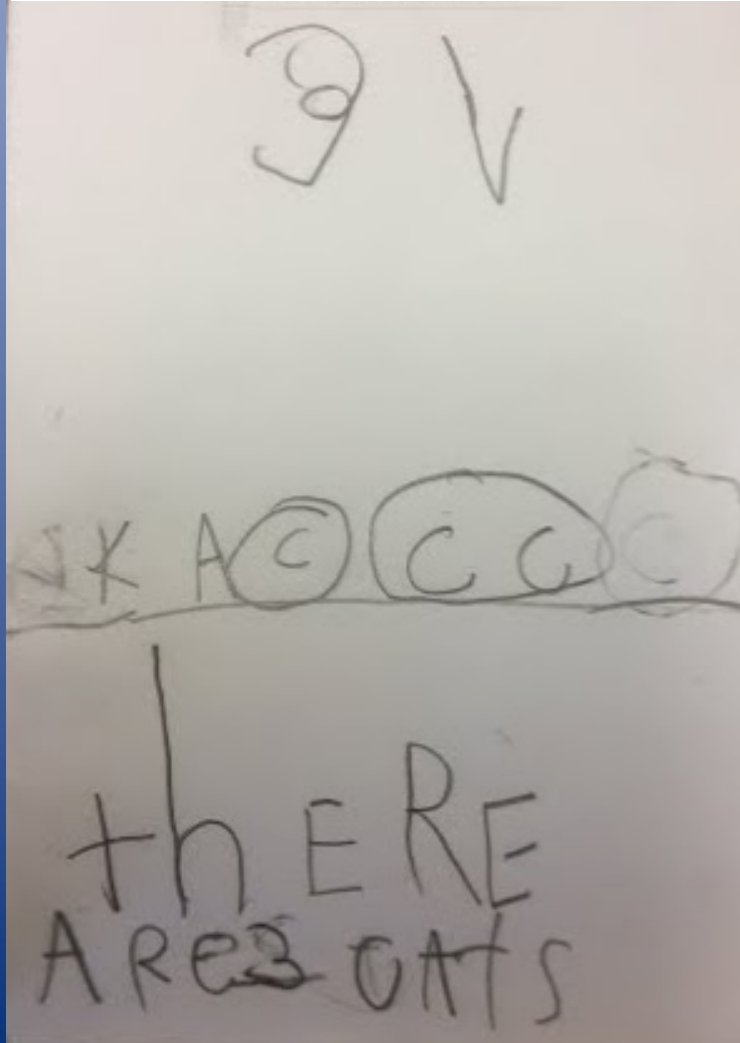
4. Look Back and Check

- Did I answer the question that was asked?
- Does my answer make sense?
- Check your math



Problem Solving In Kindergarten

There were two cats on Mrs. Knott's bed.
Annabelle put one more cat on the bed.
How many cats were on Mrs. Knott's bed?



Student Strengths

Understanding of Problem

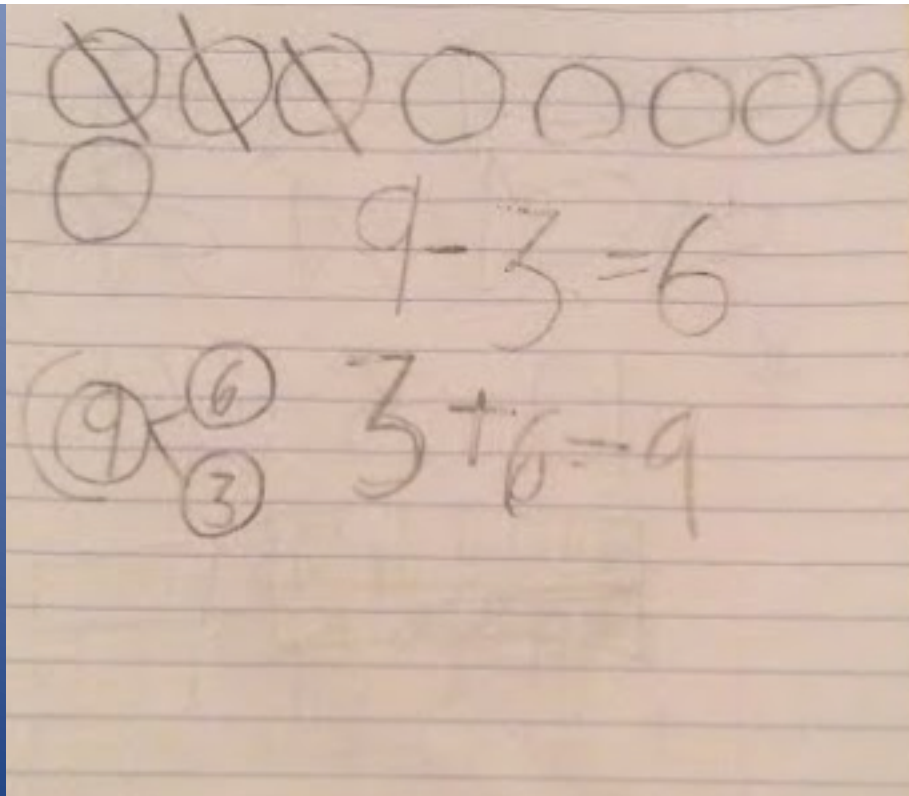
Concrete and Pictorial Representation with labels

Points for Instruction

Transition to adding an equation to represent thinking

Problem Solving in Grade 1

Riley had 9 cookies. He ate 3 of them.
How many cookies did he have left?



Student Strengths

Points for Instruction

Understanding of Problem

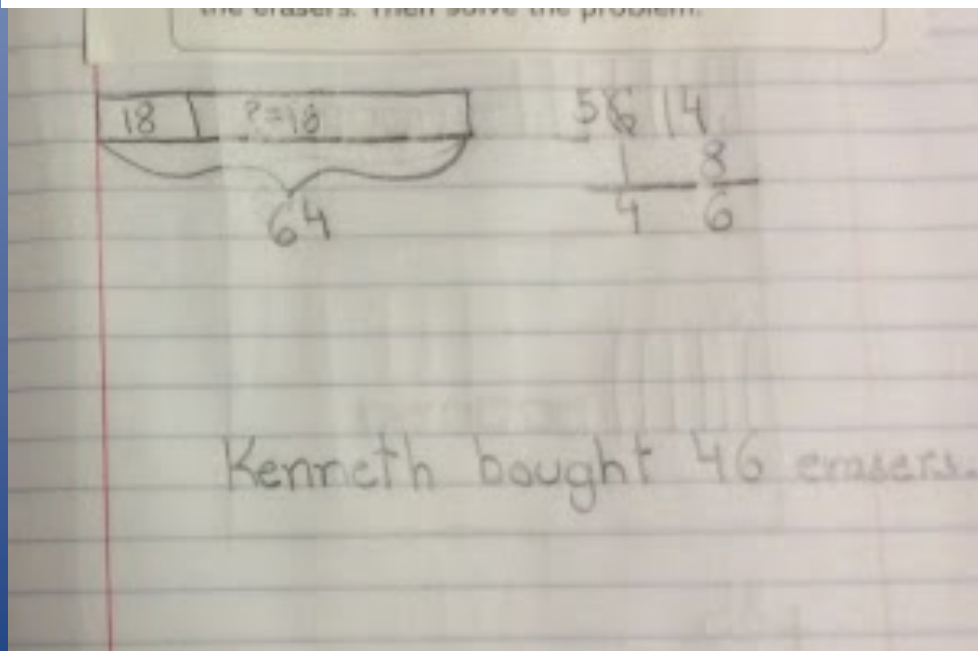
Labeling of work to make model more clear

Modeling with a concrete representation, abstract number bond, and equations

Adding an answer statement to the work to clearly answer the question

Problem Solving in Grade 2

Jerry and Kenneth bought 64 erasers in all. Jerry bought 18 erasers. How many erasers did Kenneth buy? Draw a bar model to represent the erasers. Then solve the problem.



Student Strengths

Understanding of Problem – Bar Model demonstrates part-part-whole relationship

More traditional algorithm with regrouping

Points for Instruction

Introduce alternate types of bar modeling to extend thinking

Introduce and model multi-step problems.

Problem Solving in Grade 3

5,099 passengers are on a cruise ship. 1,825 are children. How many more adults than children are on the ship?

Handwritten student work showing a problem-solving process. At the top, a bar model is drawn with two bars: the top bar is labeled "C 1825" and the bottom bar is labeled "A 1825 3274". A bracket on the right side of the bars is labeled "5099". Below the bar model, two subtraction problems are shown. The first is $3274 - 1825 = 1449$. The second is $5099 - 1825 = 3274$. Below these, two addition problems are shown. The first is $1449 + 1825 = 3274$. The second is $3274 + 1825 = 5099$. At the bottom, a sentence is written: "There are 1449 more adults than children on the ship."

Student Strengths

Points for Instruction

Understanding of Problem: Bar Model represents comparison relationship

Creating a similar problem based on what has been solved.

Multiple steps needed to solve the answer to the problem.

Introducing an alternate bar model to solve multiplication and division equations.

Problem Solving in Grade 4

A drink costs \$1.25. A drink and a burger cost \$4.95. A drink, burger and fries cost \$7.20.

Student Strengths

Points for Instruction

Understanding of Problem: Bar Model clearly labeled with equations and checking work
Multiple steps included

Continue to extend use of bar models for problem-solving by incorporating alternative bar models

Reflection on learning

Increasing complexity with multiple bar models to show work

Handwritten student work showing a bar model and calculations:

Bar Model:

d	b	f
1.25	3.70	2.25
4.95		
7.20		

check:

$$\begin{array}{r} 4.95 \\ + 3.70 \\ \hline 8.65 \end{array}$$

$$\begin{array}{r} 3.70 \\ + 1.25 \\ \hline 4.95 \end{array}$$

7.20 - 4.95 = 2.25

2.25 = cost of fries

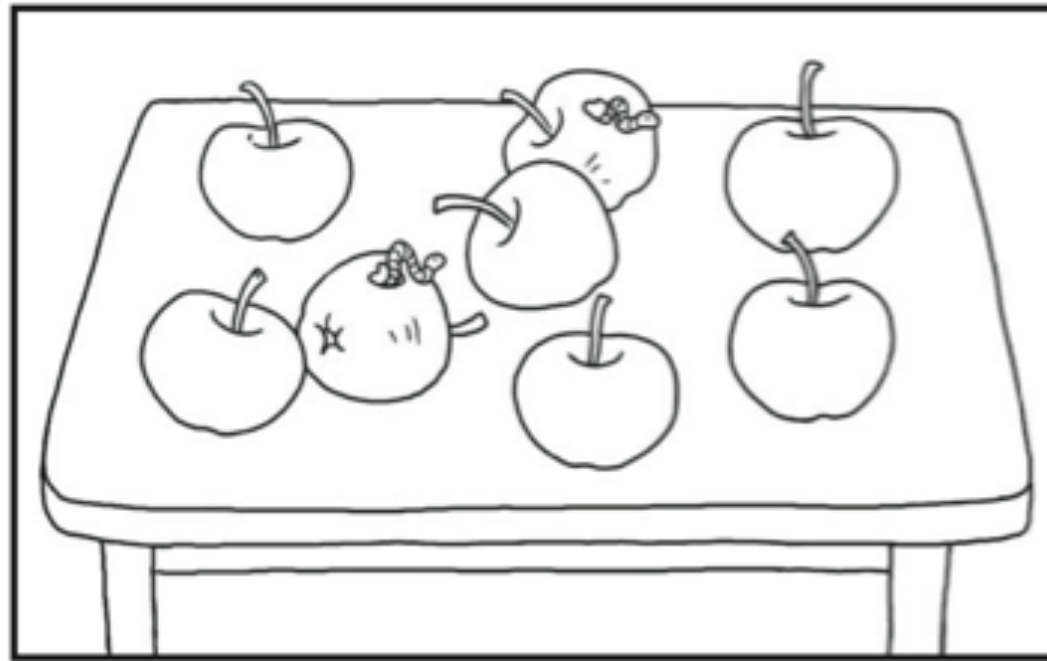
I learned that you can add on to a part-part-whole model. And that you can solve problems without a question.

- Raula & Sany

The fries cost \$2.25.

The burger costs \$3.70.

Kindergarten Problem & Reasoning



Sam thinks he has enough apples for 10 friends.
Is he right? Circle.

Yes

No

Explain your thinking.

Student Examples

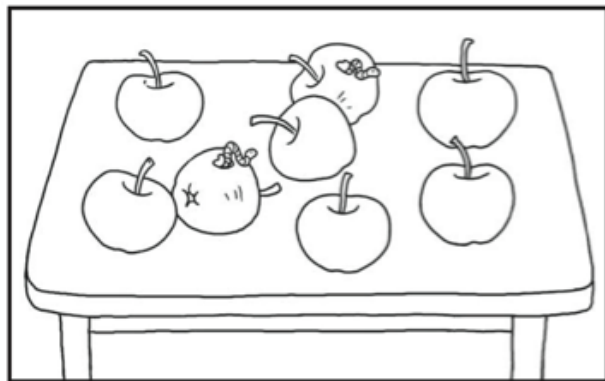
Teacher scribes for students.

"No, there's not 10. There's 8."

"No, because there's 8 apples and 10 children."

"No, because there are 2 worm ones."

"No, only 8 apples and 10 friends? That is not true!"



Sam thinks he has enough apples for 10 friends.
Is he right?

Yes
"No, because two
are not good. Now
there are six
apples. He needs
four more."

Grade Four Problem & Reasoning

2. Read the following problem:

Fiona collects 336 cans for recycling.

Daniel collects 42 more cans than Fiona.

Gary collects 61 fewer cans than Daniel.

How many cans do they collect in total?

Below is Sam's work. Sam made a mistake. Solve the problem correctly, find his mistake and explain how he can fix it.


F	$\boxed{336}$	}	?	$\begin{array}{r} 336 \\ + 42 \\ \hline 378 = \text{Daniel} \end{array}$	$\begin{array}{r} \overset{1}{3}\overset{1}{3}6 \text{ F} \\ + 378 \text{ D} \\ \hline 714 \\ + 275 \text{ G} \\ \hline 989 \end{array}$
D	$\boxed{33642}$			$\begin{array}{r} 336 \\ - 61 \\ \hline 275 = \text{Gary} \end{array}$	
G	$\boxed{? : 61}$ $\underbrace{\hspace{1.5cm}}_{336}$				

They collected 989 cans in total.

My work

$$\begin{array}{r}
 \text{F } 336 \\
 \text{D } 336 \\
 \text{G } 317 \\
 \hline
 1031
 \end{array}$$

$$\begin{array}{r}
 378 \\
 - 61 \\
 \hline
 317
 \end{array}$$

Together they
collected 1031
cans for 

Sam's mistake

What Sam did = He
Used fionas amount
He was supposed
to use Daniels
amount, this threw
off his whole
answer

District-Level Problem-Solving Rubric

Student: _____

Date of Assessment: _____

Grade 4 Math Problem Solving Rubric-District Assessment

*This rubric is to be used with the **first problem** of the district wide common math problem solving assessments*

Construct Measured	Score Point 4	Score Point 3	Score Point 2	Score Point 1
Accuracy		I solved the problem correctly.		I did not solve problem correctly.
Strategy	I solved the problem using an efficient strategy.	I solved the problem using an appropriate strategy that matches how I got the answer.	I attempted to solve the problem using an incorrect and/or inefficient strategy.	I did not show a strategy.
Model	I modeled the problem using a clear and labeled drawing or diagram, chart, graph, or equation.	I modeled the problem using a drawing or diagram, chart, graph, or equation that represents the problem.	I attempted to model the problem using a drawing, chart, graph, or equation.	I did not model the problem.
Score	Advanced 11	Proficient 10 9 8	Needs Improvement 7 6 5	Warning 4 3



*This rubric is to be used with the **second problem** of the district wide common math problem solving assessments.*

	Construct Measured	Score Point 4	Score Point 3	Score Point 2	Score Point 1
Student ability to solve the problem themselves	Accuracy		I solved the problem correctly.		I did not solve the problem correctly.
	Strategy	I solved the problem using an efficient strategy.	I solved the problem using an appropriate strategy that matches how I got my answer.	I attempted to solve the problem using an incorrect and/or inefficient strategy.	I did not show a strategy.
	Model	I modeled the problem using a clear, labeled drawing or diagram, chart, graph, or equation.	I modeled the problem using a drawing or diagram, chart, graph, or equation that represents the problem.	I attempted to model the problem using a drawing, chart, graph, or equation.	I did not model the problem.
Score		Advanced 11	Proficient 10 9 8	Needs Improvement 7 6 5	Warning 4 3
Student ability to identify and explain the math error	Identification of Math Error		I correctly identified the math error.		I did not correctly identify the math error.
	Explanation for Correcting Error	My explanation for correcting the math error is correct, very clear and addresses the error made.	My explanation for correcting the math error is correct, reasonably clear and addresses the error made.	Some parts of my explanation for correcting the math error are incorrect, unclear or missing.	My explanation for correcting the math error is incorrect, missing or all parts are unclear.
Score		Advanced 7	Proficient 6 5	Needs Improvement 4 3	Warning 2